

# Goose Creek Subbasin Assessment and Total Maximum Daily Loads

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**FINAL**



**Department of Environmental Quality  
December 22, 2003**



# **Goose Creek Subbasin Assessment and Total Maximum Daily Loads**

**December 22, 2003**

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## Acknowledgments

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Mike Etcheverry, Allan Monek, Karen Georgeson, and Jennifer Claire collected samples for the *Goose Creek SBA and Total Maximum Daily Loads*. Robert Sharpnack compiled ArcView figures. Jennifer Claire reviewed the document in its early stages, while Sonny Buhidar and Jennifer Claire acted as sounding boards for the issues within the document. Sean Woodhead collected the biological information along with the many Beneficial Use Reconnaissance Program's crews the Department of Environmental Quality –Twin Falls Regional Office has had over the years.

Cover photo by Karen Georgeson.



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## Abbreviations, Acronyms, and Symbols

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<b>§303(d)</b>	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section	<b>CFR</b>	Code of Federal Regulations (refers to citations in the federal administrative rules)
<b>μ</b>	micro, one millionth	<b>cfs</b>	cubic feet per second
<b>μg/L</b>	microgram per liter	<b>cfu</b>	Colony forming units
<b>μS/cm</b>	microsiemens per centimeter	<b>cm</b>	centimeters
<b>§</b>	Section (usually a section of federal or state rules or statutes)	<b>col</b>	Colonies
<b>AMP</b>	Allotment Management Plan	<b>CWA</b>	Clean Water Act
<b>ANOVA</b>	Analysis of Variance	<b>DEQ</b>	Department of Environmental Quality
<b>BAER</b>	Burned Area Emergency Rehabilitation	<b>DO</b>	dissolved oxygen
<b>BAG</b>	Basin Advisory Group	<b>EA</b>	Environmental Assessment
<b>BLM</b>	United States Bureau of Land Management	<b>E. coli</b>	<i>Escherichia coli</i>
<b>BMP</b>	best management practice	<b>EPA</b>	United States Environmental Protection Agency
<b>BOD</b>	biochemical oxygen demand	<b>EQUIP</b>	Environmental Quality Incentive Program
<b>BOR</b>	United States Bureau of Reclamation	<b>F</b>	Fahrenheit
<b>BURP</b>	Beneficial Use Reconnaissance Program	<b>FPA</b>	Idaho Forest Practices Act
<b>BYU</b>	Brigham Young University	<b>Ft</b>	Feet
<b>C</b>	Celsius, Centigrade	<b>FWS</b>	U.S. Fish and Wildlife Service
<b>C&amp;H</b>	Cattle and Horse	<b>GIS</b>	Geographical Information Systems
<b>CAFO</b>	Confined Animal Feeding Operation	<b>GPM</b>	Gallons per minute
		<b>gpm/ft</b>	Gallons per minute per foot

<b>GW</b>	Ground water	<b>LC</b>	load capacity
<b>H<sub>a</sub></b>	Alternative hypothesis	<b>m</b>	meter
<b>HIP</b>	Habitat improvement project	<b>m<sup>3</sup></b>	cubic meter
<b>H<sub>0</sub></b>	Null Hypothesis	<b>m<sup>3</sup>/s</b>	cubic meter per second
<b>HUC</b>	Hydrologic Unit Code	<b>mi</b>	mile
<b>I.C.</b>	Idaho Code	<b>mi<sup>2</sup></b>	square miles
<b>IDA</b>	Idaho Department of Agriculture	<b>MBI</b>	macroinvertebrate index
<b>IDT</b>	Idaho Department of Transportation	<b>MGD</b>	million gallons per day
<b>IDAPA</b>	Refers to citations of Idaho administrative rules	<b>Mg</b>	Megagram or Metric Ton
<b>IDFG</b>	Idaho Department of Fish and Game	<b>Mg/y</b>	Metric ton per year
<b>IDL</b>	Idaho Department of Lands	<b>mg/L</b>	milligrams per liter
<b>IDWR</b>	Idaho Department of Water Resources	<b>mg/m<sup>2</sup></b>	milligram per square meter
<b>INFISH</b>	The federal Inland Native Fish Strategy	<b>mm</b>	millimeter
<b>IRIS</b>	Integrated Risk Information System	<b>MOS</b>	margin of safety
<b>ISCC</b>	Idaho Soil Conservation Commission	<b>MWMT</b>	maximum weekly maximum temperature
<b>km</b>	kilometer	<b>N</b>	Nitrogen
<b>km<sup>2</sup></b>	square kilometer	<b>n.a.</b>	not applicable
<b>kwh/m<sup>2</sup>/day</b>	Kilowatt per hour per square meter per day	<b>NH<sub>3</sub></b>	Ammonia
<b>LA</b>	load allocation	<b>NO<sub>x</sub></b>	General symbol for nitrite and nitrate in a solution
		<b>NA</b>	not assessed
		<b>NB</b>	natural background
		<b>nd</b>	no data (data not available)

**PCR** primary contact recreation

**ppm** part(s) per million

**NFS** not fully supporting

**NPDES** National Pollutant Discharge  
Elimination System

**NRCS** Natural Resources Conservation  
Service

**P** Phosphorus

**PFC** proper functioning condition

**Q** Discharge, flow

**RM** River Mile

**S&G** Sheep and Goat

**SBA** SBA

**SC** Specific conductivity

**SCD** Soil Conservation District

**SFI** DEQ's stream fish index

**SMI** DEQ's stream macroinvertebrate  
index

**SMZ** Streamside Management Zone

**SR-HC** Snake River, Hells Canyon

**STATSGO** State Soil Geographic  
Database

**TDS** total dissolved solids

**T&E** threatened and/or endangered  
species

**TFRO** Twin Falls regional Office

**TMDL** total maximum daily load

**TN** total nitrogen

**TP** total phosphorus

**TS** total solids

**TSI** trophic state index

**TSS** total suspended solids

**U.S.** United States

**USC** United States Code

**USDA** United States Department of  
Agriculture

**USDI** United States Department of the  
Interior

**USFS** United States Forest Service

**USFWS** United States Fish and Wildlife  
Service

**USGS** United States Geological Survey

**WAG** Watershed Advisory Group

**WBAG** Water Body Assessment Guidance

**WLA** wasteload allocation

**WQLS** water quality limited segment

**WQMP** water quality management plan

**WQRP** water quality restoration plan

**WQS** water quality standard



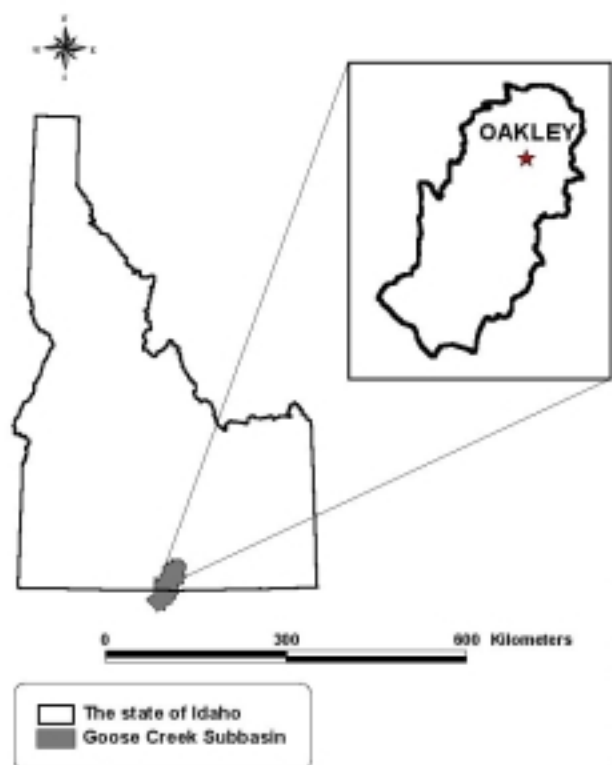
## Executive Summary

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The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to §303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the Goose Creek Subbasin that have been placed on what is known as the "§303(d) list."

This SBA (SBA) and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the Goose Creek Subbasin located in south central Idaho. The first part of this document, the SBA, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current 1998 §303(d) list of water quality limited water bodies. Eight segments of the Goose Creek Subbasin were listed on this list. The SBA portion of this document examines the current status of §303(d) listed waters and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

The 1996 §303(d) list for the state of Idaho (DEQ 1994) included four stream segments occurring within the region designated as the Goose Creek Subbasin. These same four stream segments remain on the 1998 §303(d) list, although nearly 9 miles of Trapper Creek (from the headwaters to Ibex Hollow) were removed. Four additional waters were added to the list in 1998 by the state and one by the U.S. Environmental Protection Agency (EPA). The *Goose Creek SBA and Total Maximum Daily Loads* (SBA-TMDL) for surface waters of hydrological unit code 17040211 describes those nine water bodies and 17 pollutants that are listed on the 1998 §303(d) list prepared by the state of Idaho, including the EPA addition (see table 1). In addition, four other pollutant/water body combinations are included in the SBA-TMDL due to water quality monitoring within the subbasin. The listed water bodies are considered "water quality limited" and do not meet their beneficial uses as defined by state of Idaho water quality standards. The SBA provides information pertaining to existing and designated beneficial uses. The information in the SBA includes those pollutants and the sources of pollutants that are affecting these beneficial uses. The information was obtained from a variety of sources including monitoring efforts of the Department of Environmental Quality (DEQ) and other agencies and individuals. The public has also been involved in the development of the SBA-TMDL through a variety of venues. Most notably, public meetings were held in the towns of Burley and Oakley.



<i>Hydrologic Unit Code</i>	17040211
<i>Subbasin Drainage Size</i>	1,791 km <sup>2</sup> in Idaho 2,902 km <sup>2</sup> Total
<i>Total Stream Length</i>	2,522 km
<i>Listed Stream Length</i>	147.6 km
<i>Applicable Water Quality Standards</i>	<ul style="list-style-type: none"> <li>▪ IDAPA 58.01.02.200-General Surface Water Quality Criteria</li> <li>▪ IDAPA 58.01.02.250-Surface Water Quality Criteria for Aquatic Life Use Designations</li> </ul>
<i>Beneficial Uses Affected</i>	<ul style="list-style-type: none"> <li>▪ Cold water aquatic life</li> <li>▪ Salmonid spawning</li> <li>▪ Secondary contact recreation</li> </ul>
<i>Pollutants of Concern</i>	<ul style="list-style-type: none"> <li>▪ Sediment</li> <li>▪ Nutrients (Total phosphorus)</li> <li>▪ Bacteria</li> <li>▪ Temperature</li> <li>▪ Low Dissolved Oxygen</li> </ul>

**Figure 1. Goose Creek Subbasin and vital statistics.**

**Table 1. 1998 §303 (d) list.**

Water body	Pollutants
Goose Creek	BACT <sup>a</sup> , DO <sup>b</sup> , QALT <sup>c</sup> , NUT <sup>d</sup> , SED <sup>e</sup> , TEMP <sup>f</sup>
Trapper Creek	BACT, DO, QALT, SED.
Birch Creek	BACT, DO, SED
Cold Creek	UNKN <sup>g</sup>
Bluehill Creek	UNKN
Beaverdam Creek	UNKN
Big Cottonwood Creek	UNKN
Mill Creek	TEMP
Lower Goose Creek Reservoir	DO, QALT, NUT, SED

a BACT = bacteria

b DO = low dissolved oxygen

c QALT = flow alteration

d NUT = nutrients

e SED = sediment

f TEMP = elevated water temperature

g UNKN = unknown pollutants

## Subbasin at a Glance

The general physical and biological characteristics (Figure 1) of the Goose Creek Subbasin have a strong influence on the water quality of the subbasin. Land use in the subbasin is predominantly rangeland ( $\cong$  43 percent). Irrigated agriculture also exists in the lower elevation, northern portion of the subbasin where water is either pumped from the ground or diverted from Goose Creek Reservoir. The major population center of the basin is the town of Oakley. The subbasin contains three different water sources. The first of these is runoff from the snowpack and other precipitation events in the mountainous region to the east and west. The second is the Goose Creek-Golden Valley Aquifer below Oakley, which is part of the Eastern Snake River Plain Aquifer. The final source is a geothermal layer that feeds several geothermal springs along the ecoregional boundary. These sources affect water quality to varying degrees. To a small extent, stream temperatures may be slightly elevated due to geothermal activity in the region. The water from the local aquifer likely does not affect water quality significantly, as the amount of water entering the streams and rivers of the subbasin from this source and the geothermal source is minor in comparison with snowpack and precipitation.

The subbasin land forms, vegetation, topography, and precipitation can be defined by two ecoregions. The predominant ecoregion of the subbasin is the Northern Basin and Range. The Northern Basin and Range ecoregion is predominantly sage-steppe-juniper mountain lands. Most of the surface streams are intermittent or ephemeral in nature due to low annual precipitation and evaporation. Consequently, limited riparian habitat exists within the subbasin. Those streams that remain perennial usually form from spring sources in the more mountainous regions of the subbasin. Along these stream courses some riparian habitats persist.

Sediment, low dissolved oxygen, and bacteria are the most common listed pollutants in the subbasin. These pollutants were listed for the four 1996 §303(d) listed water bodies within the subbasin. Other listed pollutants and stressors include nutrients, flow, temperature, and “unknown”. The SBA portion of the SBA-TMDL determines the current amount of each particular pollutant in each of the watersheds of the §303(d) listed water bodies. The SBA also determines what impact to the beneficial uses each pollutant may have.

## Key Findings

In general, the impacts to the beneficial uses were determined by assessing the biological communities and the limited water chemistry data available. When these two data sets were in agreement with one another, appropriate actions, such as completing a TMDL or delisting the stream, were undertaken.

The water quality of the Goose Creek Subbasin, in general, is of high quality. Nutrients are a listed pollutant in the Goose Creek Reservoir and Goose Creek segments of the subbasin. In these reaches it was determined that total phosphorus (TP) may be a limiting nutrient. In the Beaverdam Creek Watershed it was also determined that TP was in excess, but that a natural source of TP existed within the watershed. In the Beaverdam Creek and other watersheds

nitrogen compounds are not in excess of EPA “Blue Book” (*Water Quality Criteria 1972*) recommendations (EPA 1975). Background TP concentrations at a Nevada sampling site in Goose Creek averaged 0.083 milligrams per liter (mg/L) annually, while concentrations near the end of the reach averaged 0.099 mg/L. Only nonpoint sources and natural soil-associated phosphorus contribute to this increase in TP concentration, as there are no point sources located within the watershed. In the reservoir annual TP concentrations averaged 0.026 mg/L. Total phosphorus concentrations in the Trapper Creek Watershed have averaged 0.117 mg/L annually. Natural background levels in the Beaverdam Creek Watershed were determined to be 0.129 mg/L TP. Consequently, the target selected for the Beaverdam Creek Watersheds was also set at natural background. The EPA has set guidelines for TP concentrations in streams flowing into lakes and reservoirs. As such, Goose Creek and Trapper Creek TP concentration targets are set at 0.05 mg/L. If the analysis were based solely upon TP concentrations, then a 49 percent reduction in TP would be required for nonpoint sources within the Goose Creek Watershed and a 59 percent reduction would be required for Trapper Creek. However, taken in context with the other nutrients (which are often below detection limits) and chlorophyll *a* concentrations, a nutrient TMDL is not warranted in Goose Creek whereas one is required in the Trapper Creek drainage.

For lakes and reservoirs, the EPA has set guidelines for TP concentrations at 0.025 mg/L. As a result, the Goose Creek Reservoir TP concentration target is set at 0.025 mg/L. No reductions in TP will be required for nonpoint sources within the Goose Creek Subbasin in order to meet these targets within the reservoir. The other listed streams and pollutants in the subbasin, in general, were below any nutrient standard or guideline established for the protection of beneficial uses.

Flow and habitat alteration issues were not discussed in the SBA-TMDL due to current DEQ policy. It is DEQ policy that flow and habitat alterations are pollution, but not pollutants requiring TMDLs. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants as “pollution.” TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. These forms of pollution will remain on the §303(d) list; however, TMDLs will not be completed on segments listed with altered flow or habitat as a pollutant at this time.

Temperature, under the current standards, is a listed pollutant for Goose Creek and Mill Creek. In other areas of the state, bioassessment data conflict with current temperature information and water quality standards. This is likely the result of the state’s current water quality standards being derived from an outdated understanding of the cold water aquatic life’s temperature requirements. Consequently, DEQ is participating in a regional review of temperature criteria, which is being organized by EPA Region 10. Following the conclusion of the temperature review, temperature exceedances documented now in the Goose Creek Subbasin will be reassessed and, if needed, temperature TMDLs will be completed. Until that review is completed, temperature TMDLs in the Goose Creek Subbasin will proceed. Streams with fully supported beneficial uses and the different shade components of those streams will be used to set the shade components for temperature TMDLs developed and presented in this document.



The following tables (2-4) summarize the TMDLs that were completed, recommended delisting actions as a result of the Goose Creek SBA, and stream/pollution combinations retained on the §303(d) list.

**Table 2. Delistings in the Goose Creek Subbasin**

Segment	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant
Goose Creek	Nutrients –TP <sup>a</sup>	Bacteria	Dissolved Oxygen
Trapper Creek	Bacteria	Dissolved Oxygen	
Birch Creek	Sediment- TSS <sup>b</sup>	Dissolved Oxygen	
Cold Creek	Unknown		
Blue Hill Creek	Unknown		
Big Cottonwood Creek	Unknown		
Emery Creek	Bacteria		
Mill Creek	Temperature		
Goose Creek Reservoir	Nutrients - TP	Sediment- TSS	

a TP = Total Phosphorus

b TSS = Total Suspended Sediment

**Table 3. Stream/pollution combinations retained on the §303(d) list.**

SEGMENT	TMDL-POLLUTANT
Goose Creek Reservoir	Flow Alteration
Goose Creek	Flow Alteration
Trapper Creek	Flow Alteration
Big Cottonwood Creek	Flow Alteration

**Table 4. Streams and pollutants for which TMDLs were developed.**

Segment	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant
Goose Creek	Temperature	Sediment-Bedload			
Trapper Creek	Nutrients –TP <sup>a</sup>	Sediment-Bedload			
Birch Creek	Nutrients -TP	Bacteria			
Cold Creek	Temperature				
Beaverdam Creek	Nutrients -TP	Temperature	Bacteria	Sediment-TSS <sup>b</sup>	Dissolved Oxygen
Little Cottonwood Creek	Bacteria				
Left Hand Fork Beaverdam Creek	Nutrients -TP	Sediment-TSS	Bacteria		

a TP = Total Phosphorus

b TSS = Total Suspended Sediment